

GGOS

**Bureau of Products and Standards
2015-2016 Implementation Plan**

1.0 IMPLEMENTATION OVERVIEW

1.1 Introduction

The Bureau of Products and Standards (BPS) is a recent redefinition of the former Bureau for Standards and Conventions (BSC), which was established as a GGOS component in 2009. This redefinition is a consequence of a restructure of the GGOS organization in 2014. The work of the BPS is primarily focused on the IAG Services and the products they derive on an operational basis for Earth monitoring making use of various space geodetic observation techniques such as VLBI, SLR/LLR, GNSS, DORIS, altimetry, gravity satellite missions, gravimetry, etc. The Bureau builds upon existing observing and processing systems of IAG. It supports the IAG in its goal to obtain products of highest possible accuracy, consistency, and temporal and spatial resolution, which should refer to a consistent reference frame, stable over decades in time. To achieve this important goal, it is a fundamental requirement that common standards and conventions are used by all IAG components for the analysis of the different geometric and gravimetric observations. The BPS also concentrates on the integration of geometric and gravimetric parameters and the development of new products, required to address important geophysical questions and societal needs.

Charter of the Bureau of Products and Standards (BPS):

The main purpose of the BPS is to keep track of adopted geodetic standards and conventions across all IAG components as a fundamental basis for the generation of consistent geometric and gravimetric products. The work is primarily build on the IAG Service activities in the field of data analysis and combinations. The BPS shall act as contact and coordinating point regarding homogenization of standards and IAG/GGOS products. The organization structure can be considered as a system of systems, where the IAG Services shall keep their full responsibility.

More specifically the charter of the BPS may be divided into two major topics/activities:

- (1) **Standards:** This includes the compilation of an inventory regarding standards, constants, resolutions and conventions adopted by IAG and its components and a regular update of such a document. Steps shall be initiated to close gaps and deficiencies in standards and conventions. Based on the recommendations given in this inventory priorities should be defined together with dedicated experts in the field. An action plan shall be compiled, including the definition of tasks, responsibilities and a time schedule. Finally, the BPS shall propose the adoption of new standards where necessary and propagate standards and conventions to the wider scientific community and promote their use.
- (2) **Products:** The BPS shall take over a coordinating role regarding the homogenization of standards and products. The present status regarding IAG Service products shall be evaluated, including analysis and combination procedures, accuracy assessment with respect to GGOS requirements, documentation and metadata information for IAG/GGOS products. The Bureau shall initiate steps to identify user needs and requirements for geodetic products and shall contribute to develop new and integrated products. It shall also contribute to the general GGOS goal that all relevant geodetic products for Earth sciences and applications shall be made accessible through the GGOS Portal including

metadata and web services to increase visibility and enable searches in a most efficient way.

1.2 Goals and Objectives

The role of the Bureau is to provide a forum for the IAG Services and other entities involved in standards and products. In this context the BPS shall act as contact and coordinating point to share and discuss plans, progress and to develop and monitor multi-entity efforts to address GGOS requirements.

A primary goal of the BPS is to serve the goal 3 of GGOS as specified in the Terms of Reference ***“Services, Standardization, and Support (internal and external coordination) Optimal coordination, support and utilization of IAG services, as well as leveraging existing IAG resources, are critical to the progress of all goals and objectives GGOS”***.

Primary objectives:

- (1) The BPS shall ensure that common standards and conventions are implemented and adopted by all IAG components as a fundamental basis for the generation of consistent IAG/GGOS products.
- (2) The BPS shall act as contact and coordinating point for the IAG Services regarding homogenization of standards and products, whereas the IAG Services shall keep their full responsibility and visibility to manage their supporting data, products and information systems.
- (3) The BPS shall take over a coordinating role and shall define procedures to ensure an overall efficient use of resources. The primary focus of the BPS shall be on existing geodetic products and on the development of new products to meet the needs of both scientific users and society in general.

The BPS also contributes to various objectives of the GGOS goals 1 and 2 of the strategic plan (see Table 1.2.1). These objectives are under the major responsibility of other GGOS entities. Thus they are considered as secondary objectives of the BPS and they are addressed in the implementation plans of the respective GGOS entities.

Table 1.2-1: Bureau of Products and Standards (BPS): Goals and Objectives Mapping. The table identifies the primary (✓✓) and secondary (✓) Goals and Objectives that the BPS will be supporting to meet the outcomes stated in the GGOS strategic plan. Primary goals and objectives are those that are aligned with the charter of the GGOS Entity in question and are not likely to be realized without its involvement. Secondary goals and objectives are those that the given GGOS Entity can support as part of its charter.

	Goal 1 – Geodetic Information and Expertise			Goal 2 – Global Geodetic Infrastructure		Goal 3 - Services, Standardization, and Support		Goal 4 - Communication, Education, and Outreach	
	<i>Objective 1-1 – Understand societal and scientific needs and deficiencies</i>	<i>Objective 1-2 – Position GGOS as the primary source for geodetic information and expertise</i>	<i>Objective 1-3 – Connect with the larger scientific community and integrate with other Earth observing</i>	<i>Objective 2-1 – Support and advocacy for infrastructure and associated elements</i>	<i>Objective 2-2 – Lead efforts for the integration of various ground observation networks within the GGOS network</i>	<i>Objective 3-1 – Standardization</i>	<i>Objective 3-2 – Coordination and Development of IAG Services</i>	<i>Objective 4-1 – Establish a Strong Internet/Online Presence</i>	<i>Objective 4-2 – Outreach to the Technical Community and General Society</i>
Coordinating Board	✓✓	✓✓	✓	✓	✓	✓	✓	✓	✓
Consortium	✓	✓	✓✓	✓	✓	✓	✓✓		✓
Coordinating Office	✓	✓	✓	✓	✓	✓	✓	✓✓	✓✓
Bureau of N&O			✓	✓✓	✓✓	✓	✓		
Bureau of P&S	✓	✓	✓	✓		✓✓	✓✓		
Science Panel	✓✓	✓	✓✓				✓		✓

1.3 BPS Authority, Governance Structure, Management Structure, and Implementation Approach

1.3.1 BPS Authority

The BPS shall take over the responsibility to define the policies and procedures for the management and coordination activities as well as for the other tasks specified in its charter. Beside the BPS staff, the Bureau also includes the chairs of the associated GGOS components (i.e., Working Groups on Earth System Modelling and ITRS Standards) and the nominated representatives of the IAG Services to formulate the tasks and to design the necessary procedures in the field of standards and geodetic products.

The Bureau is authorized to conduct their management and coordination tasks as given in this implementation plan. This includes the specification of tasks and a time schedule for the activities of the BPS itself as well as for the associated GGOS components. The BPS is also responsible to setup procedures to measure the progress of the work with respect to the implementation plan and to undertake actions to resolve potential deficiencies. The overall procedures for the operation of the Bureau activities including the interactions with the contributing components shall be managed in an efficient way to avoid an overload of bureaucracy.

Concerning other GGOS entities and the interactions between different components, the authorities and responsibilities should be defined in the overall GGOS framework and coordinated by the GGOS Coordinating Office. The GGOS Coordinating Board acts as central oversight and decision-making body. If actions and decisions have to be taken that involve outside GGOS entities such as the IAG Services, their respective governing bodies and for general issues also the IAG Executive Committee should be consulted prior to execution.

1.3.2 Governance Structure

Not Applicable

1.3.3 Management Structure

ALLOCATION AND DISTRIBUTION OF RESOURCES

The basic configuration of resources (man-power) for the BPS will be composed by the staff members of the former Bureau for Standards and Conventions (BSC), operated by the Deutsches Geodätisches Forschungsinstitut (DGFI-TUM), the Lehrstuhl für Astronomische und Physikalische Geodäsie (APG) and the Forschungseinrichtung Satellitengeodäsie (FESG) of the Technische Universität München, within the Forschungsgruppe Satellitengeodäsie (FGS). This consortium includes in addition the Bundesamt für Kartographie und Geodäsie (BKG), Frankfurt am Main, and the Institut für Geodäsie und Geoinformation (IGG) of the University Bonn.

Staff members of the BPS:

- Director: Detlef Angermann
- Co-Director: Thomas Gruber

Geodetic fields covered by the BPS team:

- Geometry, TRF, orbits: Detlef Angermann, Urs Hugentobler, Peter Steigenberger (as associated member)
- Earth orientation, CRF: Michael Gerstl, Robert Heinkelmann (as representative of IAU)
- Gravity, height systems: Thomas Gruber, Laura Sánchez

In its current structure the following GGOS entities are associated to the BPS:

- WG “Earth System Modelling” (Chair: Maik Thomas),
- WG “ITRS Standards” (Chair: Claude Boucher)

As defined in its charter, the BPS serves as contact and coordinating point for the IAG Analysis and Combination Services. A representative from each of these services shall be selected to be included in the Bureau business as an associated member. The IAG Services have chosen their representatives (e.g., Analysis Coordinator) as associated members of the BPS.

The Bureau comprises the BPS staff members, the chairs of the associated GGOS components and the representatives of the IAG Services and other entities involved in standards (see Tab. 1.3.1). The GGOS Working Groups on Earth System Modelling and on ITRS Standards have formulated a charter and work plan which are included in this implementation plan (see appendix D).

OVERSEEING AND COORDINATING THE DAY-TO-DAY OPERATIONS

Together with the associated GGOS components the BPS will develop a task plan and define/setup procedures to oversee and coordinate day-to-day operations. The staff members of the BPS can arrange face-to-face meetings on a very flexible basis due to short distances. Other communication tools are telecons, e-mails and phone calls to coordinate the day-to-day operations, the monitoring of the schedule as well as a redefinition of tasks and responsibilities in case of need.

REPORTING OF TECHNICAL AND/OR SCIENTIFIC PROGRESS AND CONFIGURATION MANAGEMENT

The reporting of technical and/or scientific progress against schedule, as well as alignment of this progress is part of the communication plan (see Table 1.3-2). The coordination and management among all GGOS entities is given in the implementation plan of the GGOS Coordinating Office.

Table 1.3-1: Resources of the BPS

Position	Resource	Entity Contributing
BPS Director, Co-Director	Detlef Angermann, Thomas Gruber	DGFI, APG (both TUM)
BPS Team		TUM
Geometry, TRF, satellite orbits	D. Angermann, U. Hugentobler, P. Steigenberger (associated member)	+ GFZ, GSOC/DLR
Earth rotation, CRF	M. Gerstl, R. Heinkelmann (IAG Repr.)	
Gravity, height systems	T. Gruber, L. Sánchez	
WG „Earth System Modeling“	Chair: Maik Thomas	GFZ (Germany)
WG „ITRS Standards“	Chair: Claude Boucher	France
IERS Conventions Centre	Director: Gerard Pétit	BIPM (France)
IERS Analysis Coordinator	Tom Herring	MIT (USA)
IGS Representative	Urs Hugentobler (BPS staff member)	FESG/TUM (Germany)
ILRS Analysis Coordinator	Erricos Pavlis	UMBC/NASA (USA)
IVS Analysis Coordinator	John Gipson	GSFC/NASA (USA)
IDS Representatives	Frank Lemoine, John Ries	GSFS, CSR (USA)
IGFS Chair	Riccardo Barzaghi	Politecnico, Milano (Italy)
BGI Chair	Sylvain Bonvalot	IRD (France)
ICCGEM Chair	Franz Barthelmes	GFZ (Germany)
Gravity community	Jürgen Kusche (Representative)	Univ. Bonn (Germany)
IAG Representative to ISO	Johannes Ihde	BKG (Germany)
IAG Communication and Outreach	Chair: Josef Ádám	University Budapest (Hungary)
IAU Representative, WG NSFA	Robert Heinkelmann (BPS staff memb)	GFZ (Germany)
Control Body for ISO	Chair: Mike Craymer	NRCan (Canada)

Table 1.3-2: BPS Communications Plan. The table identifies the communications requirements of the BPS

Communication Type	Purpose	Medium	Frequency	Audience	Owner	Deliverables
GGOS Consortium meeting	Interactions GGOS/IAG	Face-to-face	Annually	Consortium members	CB Chair	Presentations, report of GGOS entities, minutes
GGOS CB meeting	Review status, strategic issues	Face-to-face	Twice per year (EGU, AGU)	Coordinating Board members and invitees	CB Chair	Reports of GGOS entities, minutes
GGOS EC telecons	Discussion of day-to-day business	Telecons	Monthly	GGOS EC members	CB Chair	Minutes, action items
Directors of Coordination Office, Bureaus, Science Panel	Manage day-to-day execution of Bureaus and Science Panel	Telecons	To be specified (e.g., every two months)	Directors of CO, Bureaus and Science Panel	CO Director	Progress reports, minutes, action items
BPS staff member meetings	Management of BPS day-to-day business	Face-to-Face in Munich	Every two months	BPS staff members	BPS Director	Minutes, action items
Reports of BPS and associated components	Monitoring progress	n/a	To be defined (e.g., twice per year)	Bureau Board members and invitees	BPS Director	Progress reports, minutes, action items
BPS meetings	Manage BPS business	Face-to-face or telecons	Varying	Entity members and invitees	BPS Director	Reports, minutes, action items

1.3.4 Implementation Approach

The Bureau comprises the BPS staff members, the chairs of the associated GGOS entities and the representatives of the IAG Services as well as other entities involved in standards. This configuration of the BPS ensures a close interaction among GGOS entities and IAG Services. A communication plan (see Tab. 1.3.2) has been defined and setup for a regular exchange of information, in particular regarding the homogenization of standards and IAG/GGOS products. The implementation approach should consider interactions between existing components, such as the BPS and the IERS Conventions Centre regarding standards and conventions and with the IAG Services regarding IAG/GGOS products. The interdependencies between these entities and the responsibilities should be clearly specified to ensure efficiency and straight forward approaches. The implementation approach of the BPS should also consider user needs and requirements for geodetic products as well as the development of new products, which will require novel combination approaches. For these activities the BPS should bring together the existing resources of IAG Services, and should also involve other GGOS entities (e.g., the Themes and the Science Panel). Concerning the requirements regarding infrastructure (e.g., space geodetic networks) there will be a close cooperation with the GGOS Bureau of Networks and Observations (BNO).

At present, we do not see any dependency on outside resources or approvals and also make-or-buy decisions and trade studies are not relevant for the BPS.

1.4 Stakeholder Definition

The stakeholder definition and advocacy strategies are overall tasks of GGOS (see implementation plans of the GGOS Coordinating Board and the GGOS Coordinating Office).

Table 1.4-1: BPS Stakeholders and Advocacy Strategies

STAKEHOLDERS	ADVOCACY STRATEGIES
INTERNAL STAKEHOLDERS	
GGOS Coordinating Board GGOS Coordinating Office GGOS Science Panel IAG Services	The advocacy strategies are specified in the implementation plans of the GGOS Coordinating Board and Coordinating Office (see also the communication plan given in Table 1.3-2).
EXTERNAL STAKEHOLDERS	
CEOS	The advocacy strategies are specified in the implementation plan of the GGOS Coordinating Board.

GEO	
Space Agencies	
United Nations	
Universities	
National Mapping and Geodetic Agencies	

2.0 GGOS Bureau of Products and Standards BASELINES

PROJECT BASELINES CONSIST OF A SET OF REQUIREMENTS:

The work of the BPS fundamentally depends on a long-term stable and adequate geodetic infrastructure, comprising, e.g., global terrestrial networks of observatories, Earth observing satellites, data infrastructure, analysis and combination centers of the IAG Services, as well as the GGOS Portal as central access point to IAG/GGOS products. Regarding the infra-structural issues there is a close interaction with the GGOS Bureau of Networks and Observations.

TECHNICAL OR SCIENTIFIC CONTENT THAT FORMS THE BPS:

The major contribution of the BPS is to support IAG in its goals to provide highly accurate and consistent geodetic products based on unified standards and conventions. The Bureau should address the user needs and requirements for geodetic products and should contribute to develop new products from an integration of geometric and gravimetric observations.

EXECUTION AND REPORTING:

The BPS will regularly measure the progress of the work with respect to the activities and the schedule defined in the implementation plan and will report to the other GGOS entities and to IAG as specified in the GGOS communications plan.

2.1 Requirements Baseline

The requirements addressed in this baseline are those requirements of a technical nature that will require a technical verification and validation. They represent *“the high level activities that GGOS together with the IAG must ensure”* (GGOS 2020, p. 224). Other activities pursued in support of meeting objectives and their overarching goals are presented as part of Section 2.2 (Schedule Baseline). Table 2.1-1 shows only those requirements that whose oversight has been allocated to the BPS—the totality of functional and operational requirements can be found in the Coordinating Board implementation plan. It also shows the allocation of those requirements to an IAG service or other entity. (These requirements may be rewritten at a later stage to ensure they meet requirement definition standards.)

There are the following general requirements:

- The BPS activities strongly depend on a stable geodetic infrastructure, including global terrestrial networks of observatories (Bureau of Networks and Observations), data infrastructure, analyses and combination centers providing IAG Service products.
- The interactions among GGOS entities and IAG Services and the responsibility of the different components need to be clearly specified.
- The Science Panel should support the BPS to assess the user requirements regarding existing products and the need for new products.

- The GGOS Portal should be the access point for GGOS products.

Table 2.1-1: BPS Requirement Allocation

REQUIREMENT REFERENCE	REQUIREMENT AND INTERPRETATION	GGOS ALLOCATION	IAG SERVICE (OR OTHER ENTITY) ALLOCATION
Functional Specifications for GGOS			
Determination, maintenance, and access to the global terrestrial reference frame			
ITRF-001- DER	Provision of the reference frame through a dynamic Earth reference model — The terrestrial reference frame will be provided by an operational dynamical Earth reference model which will assimilate observations of variations in the Earth’s geometry (in particular, for a reference polyhedron), the shape of the ice and ocean surfaces, the gravity field, and Earth rotation. Moreover, the reference model will also assimilate auxiliary observations, in particular meteorological observations. This dynamic Earth reference model will allow the prediction of reference trajectories for any point on Earth with temporal resolution of 1 hour and a sub-kilometer spatial resolution. The stability of the model in terms of geokinematic will be that of the reference polyhedron, i.e., sub-millimeter per year.	Bureau of P&S	IERS
ITRF-002- ORI	Tie between RFO and CM — The deviation between the reference frame origin of the terrestrial reference frame and the center of mass of the Earth system will be smaller than 1 mm at any time.	Bureau of P&S	IERS
ITRF-003- PRE	Precision of reference coordinates — The precision of coordinates of the points of the reference polyhedron of the ITRF will be better than 1 mm in the horizontal and 3 mm in the vertical component at any time.	Bureau of P&S	IERS
ITRF-004- SCA	Scale of the reference frame — The scale of the reference frame will be accurate to 0.1 ppb and stable to 0.01 ppb/yr.	Bureau of P&S	IERS

Earth rotation			
ERP-001-EOP	Earth Orientation Parameter — Earth Orientation Parameters will be determined with an accuracy of 1 mm, a temporal resolution of 1 hour, and a latency of 1 week; near real-time determinations of the Earth Orientation Parameters will be determined with an accuracy of 3 mm.	Bureau of P&S	IERS
Earth's gravity field			
GRAV-001-GEOID	Accuracy of the static geoid — The static geoid will be provided with an accuracy of 1 mm, a long-term stability of 0.1 mm/yr and a spatial resolution of 10 km.	Bureau of P&S	IAG: IGeS
GRAV-002-VAR	Accuracy of the time variable gravity field — The time variable geoid will be provided with an accuracy of 1 mm, a long-term stability of 0.1 mm/yr, a spatial resolution of 50 km, a temporal resolution of 10 days, and a latency of 0.5 months.	Bureau of P&S	IAG: IGFS
Earth system monitoring: mass transport and mass redistribution			
ESM-001-SSH	Sea surface height variations — The sea surface height variations will be determined globally with an instantaneous local accuracy of 10 mm, a temporal resolution of 10 days, a spatial resolution of 10 km, a latency of 5 days, and a local secular accuracy of 0.5 mm/yr.	Bureau of P&S	IAG: PSMSL
ESM-001-GSL	Global sea surface changes — The globally average sea surface height changes will be determined with an instantaneous accuracy of 1 mm, a temporal resolution of 10 days, a latency of 10 days, and a secular accuracy of 0.1 mm/yr. 224 Gross et al.	Bureau of P&S	IAG: PSMSL
ESM-002-CRY	Cryosphere mass balance — The variations in the surface elevation for the large ice sheets will be determined with an instantaneous local accuracy of 20 mm, a temporal resolution of 10 days, a spatial resolution of 10 km, a latency of 20 days, and a local secular accuracy of 0.2 mm/yr.	Bureau of P&S	IAG: PSMSL
ESM-003-WCY	Mass transport in the global water cycle — The mass transport in atmosphere, ocean, cryosphere, and terrestrial hydrosphere will be determined to an accuracy of an equivalent of 10 mm water cover with a temporal resolution of 10 days, a spatial resolution of 400 km, and a latency of 0.5 months.	Bureau of P&S	IAG: PSMSL
Determination, maintenance, and access to the celestial reference frame			
ICRF-001-DET	Determination of the Celestial Reference Frame — The ICRF will be defined by the coordinates of a number of extragalactic radio sources	Bureau of P&S	IERS

	distributed throughout the sky. The coordinates of the ICRF sources will be accurate to 25 microarcseconds and stable to 3 microarcseconds/yr..		
Operational Specifications for GGOS			
GGOS-Ops-5	Operate a dynamic Earth reference model assimilating comprehensive observations of variations in Earth's geometry, gravity field and rotation.	Bureau of P&S	TBD
GGOS-Ops-6	Document the procedures, standards, and conventions used to generate the products.	Bureau of P&S	None
GGOS-Ops-8	Ensure continuity, accuracy, and consistency of observations and products as the networks and data reduction procedures evolve.	Bureau of P&S	Individual GGOS sub-networks IAG Services

2.2 Schedule Baseline

The charter and the general objectives of the BPS are provided in Sect. 1.1 and 1.2. In this section some specific tasks and actions are described.

Specific tasks of the BPS:

- The Bureau should continue the work regarding standards and conventions of the former BSC (long-term activity).
- The document *“Inventory of standards and conventions used for the generation of IAG/GGOS products”*, which is currently under review by an external board, should be finalized until June 30, 2015.
- The revised version of this document should be published on the GGOS website and should be updated regularly (ongoing).
- The document should be published with open access in the geodetic literature (e.g., in the IAG Geodesist’s Handbook)
- The recommendations given in this inventory should be discussed together with dedicated experts in the field, priorities should be defined and an action plan should be compiled, including a task description, specification of responsibilities and a time schedule (December 2015).
- The present status regarding IAG Service products and related metadata information should be evaluated, gaps and deficiencies should be identified and recommendations should be provided. The work requires a close interaction between the BPS and the IAG Services as well as with the GGOS Portal. It is essential that well-defined procedures are defined to ensure effectiveness (ongoing).
- Together with the IAG Services the BPS should develop methods to assess the accuracy of current IAG/GGOS products with respect to the accuracy requirements given in the GGOS2020 document.
- If the current accuracy does not satisfy the user requirements, appropriate procedures and methods should be set up to improve the accuracy of the products. This task requires an optimal coordination, support and utilization of IAG Services, as well as leveraging existing IAG resources.
- The BPS should initiate steps to identify the user needs and requirements for products that are currently not provided by the IAG Services, required to address important geophysical questions and user needs. This task should be supported by the Science Panel and the Themes.
- The BPS should work towards the development of new products derived from a combination of geometric and gravimetric observations. If such integrated products should be routinely provided, the establishment of new analysis and/or combination centers may become necessary.

- The BPS should also support the GGOS Portal to provide the relevant information for IAG/GGOS products, including metadata and should also contribute to promote the geodetic products to the wider scientific community.

2.3 Resources

The work force requirement for the activities of the BPS is estimated to be in the order of about one full-time position per calendar year, composed by the seven BPS staff members of DGFI-TUM, APG, FESG, GFZ and GSOC/DLR (see sect. 1.3.3) and by other representatives of the BPS (e.g., WG chairs, associated members).

Infrastructure requirements, including computer servers and other supporting technologies (e.g., for tele- or videoconferences) will be provided by the host institutions.

3.0 CHANGE LOG

Table 3-1: GGOS Bureau of Products and Standards Implementation Plan Change Log

VERSION	RELEASE DATE	SYNOPSIS OF RELEASE
X.Y	[YMMDD]	[Synopsis goes here]
1.0	140801	First draft version
2.0	150326	Second draft version for review of GGOS CB in Vienna (April 2015)
3.0	150528	Revised version (May 2015)

4.0 APPENDICES

Appendix A Abbreviations

APG	Lehrstuhl für Astronomische und Physikalische Geodäsie, TU München
BKG	Bundesamt für Kartographie und Geodäsie, Frankfurt/Main
BNO	Bureau of Networks and Observations
BPS	Bureau of Products and Standards
BSC	Bureau for Standards and Conventions
CB	Coordinating Board
CEOS	Committee on Earth Observations Satellites
CO	Coordinating Office
CRF	Celestial Reference Frame
DGFI-TUM	Deutsches Geodätisches Forschungsinstitut der Technischen Universität München
DLR	Deutsches Zentrum für Luft- und Raumfahrt
DORIS	Doppler Orbitography and Radiopositioning Integrated by Satellite
EC	Executive Committee
EOP	Earth Orientation Parameter
FESG	Forschungseinrichtung Satellitengeodäsie, Technische Universität München
FGS	Forschungsgruppe Satellitengeodäsie
GEO	Group on Earth Observation
GEOSS	Global Earth Observation System of Systems
GFZ	Deutsches GeoForschungsZentrum Potsdam
GIAC	GGOS Interagency Committee
GGIM	Global Spatial Information Management
GGOS	Global Geodetic Observing System
GNSS	Global Navigation Satellite System
IAG	International Association of Geodesy
IAU	International Astronomical Union
ICRF	International Celestial Reference Frame
IDS	International DORIS Service
IERS	International Earth Rotation and Reference Systems Service
IGFS	International Gravity Field Service
IGG	Institut für Geodäsie und Geoinformation, Universität Bonn
IGS	International GNSS Service
ILRS	International Laser Ranging Service
ITRF	International Terrestrial Reference Frame
IVS	International VLBI Service for Geodesy and Astrometry
LLR	Lunar Laser Ranging
SLR	Satellite Laser Ranging
TRF	Terrestrial Reference Frame

UN	United Nations
VLBI	Very Long Baseline Interferometry
WG	Working Group

Appendix B Glossary

Appendix C References

PLAG, H.P AND M. PEARLMAN (EDITORS): GLOBAL GEODETIC OBSERVING SYSTEM – MEETING REQUIREMENTS OF A GLOBAL GEODETIC SOCIETY ON A CHANGING PLANET IN 2020, SPRINGER 2009, DOI: 10.1007/s10291-007-0067-7.

Appendix D GGOS Entities associated to the BPS

D.1. GGOS Working Group "Contributions to Earth System Modelling"

(Maik Thomas)

Purpose

The main purpose of the GGOS Working Group on "Contributions to Earth System Modelling" is to promote the development of an integrated Earth system model that is simultaneously applicable to all geodetic parameter types (Earth rotation, gravity and surface geometry) and observation techniques in order to contribute to:

- a deeper understanding of dynamical processes in the Earth system integrally reflected in geodetic monitoring data;
- the establishment of a link between the global time series of geodetic parameters delivered by GGOS and relevant process models;
- a consistent integration and interpretation of observed geodetic parameters derived from various observation techniques;
- the utilization of geodetic observations for the interdisciplinary scientific community (in cooperation with GGOS WG on Data and Information Systems).

Objectives

The overall long-term goal is the development of a comprehensive numerical Earth system model for the homogeneous processing, interpretation and prediction of geodetic parameters with interfaces allowing the introduction of constraints provided by geodetic time series of global surface processes, rotation parameters and gravity variations. This ultimate goal implicates the following objectives:

- development of a physically consistent modular dynamic Earth system model considering the interaction and relationship between surface deformation, Earth rotation and gravity field variations as well as the interactions and physical fluxes between all relevant sub-systems;
- promotion of homogeneous processing of geodetic monitoring data (de-aliasing, reduction) by process modeling to improve analysis of geodetic parameter sets;
- contributions to the interpretation of geodetic parameters derived from different observation techniques by developing model based strategies to separate underlying physical processes;
- application of forward modelling and inversion methods in order to predict geodetic quantities and to invert geodetic observations for the underlying causative processes;
- development and implementation of passive (*forcing*) and active (*dynamic*) coupling algorithms to ensure consistent interactions and physical fluxes among sub-systems;
- contributions to the integration of geodetic observations based on different techniques by i) applying up- and down-scaling tools to establish a connection from local data to global processes and vice versa and ii) introducing data assimilation techniques into

numerical process models in order to provide a tool for validation and consistency tests of various geodetic products;

- preparation of level 2 and 3 products for the interdisciplinary scientific community.

Current action items

- define consistent standards, parameters, analysis strategies and formats for all components of the unconstrained modular system model approach;
- identify relevant interactions among subsystems and appropriate parameterizations, in particular to represent the dynamic links between near-surface fluids and the “solid” Earth;
- develop a strategy to ensure physical consistency, in particular mass conservation;
- develop strategies for the separation of temporal variations of Earth rotation, gravity and geoid into individual causative physical processes.

Appendix D GGOS Entities associated to the BPS

D.2. GGOS Working Group "ITRS Standards"

(Claude Boucher)

This group was initially established to investigate the strategy to obtain the adoption by the International Standardization Organization (ISO) of a standardization document related to ITRS.

Following the initial work done by the group, a proposal was submitted to ISO by France. This proposal was a New Work Item Proposal (NWIP) related to ITRS submitted to the ISO TC 211 on Geographical information, to which IAG is a liaison.

ISO finally decided that a preliminary study demonstrating the importance of geodetic references at large was necessary before going further in the direction of the initial proposal. A project (19161) was therefore established within ISO TC211 WG4 and chaired by Claude Boucher. The project report was finalized in January 2015, reviewed and finally submitted to WG4 for approval and decision of further actions.

The report ends with some recommendations :

- To develop a standard related to ITRS
- To make further studies about the interest and feasibility of a standard on vertical references
- To make similar action for universal identification of geodetic stations
- To work to improve geodetic terminology, including update of existing standards

The GGOS WG was in stand-by during this time. But assuming that the proposal about ITRS will be ultimately approved by ISO TC211, it seems opportune to reactivate this WG with a new mandate, namely drafting the document related to ITRS, and to update the membership of this WG.